Amendments to the specification

On page 1, please replace the paragraph starting on line 5 with the following:

This application is a continuation of U.S. Patent Application Number 10/044,081, filed on January 11, 2002, which claims the benefit of United States Provisional Patent Application Number 60/261,297, filed January 11, 2001, both of which [[is]]are incorporated herein by reference in [[its]]their entirety.

On page 4, please replace the paragraph starting on line 23 with the following:

In still another aspect, the invention includes a method of injecting a polymer liquid into an internal body site in a subject to form a ~~solidfied~~solidified or hardened polymer plug at the site. The method includes positioning against or adjacent the internal body site, the distal end of an instrument having a distal-end electrode needle which can be activated to produce localized heating. With the needle so positioned, it is activated under heating conditions. The polymer liquid is then injected into the tumor, before, during or following the activating step, such that the needle and surrounding tumor region is at a temperature that allows introduction of the polymer solution through the needle and hardening at the site of injection.

On page 5, please replace the paragraph starting on line 27 with the following:

Figure 8 ~~illustreates~~illustrates an embodiment of a needle electrode configured to penetrate tissue.

On page 10, please replace the paragraph starting on line 4 with the following:

"Polymer liquid" refers, without limitation to a flowable or fluid form of a polymer, including a thermoset polymer or a thermoplastic polymer. A "thermoset polymer" refers to a polymer that sets by cross-linking reactions that may be initiated or accelerated by the application of heat. Polymer setting or solidification is thus irreversible. A "thermoplastic polymer" is one like ~~polymethylmetharcylate~~polymethylmethacrylate, that has a glass transition temperature at which the polymer converts (or is in the process of converting) reversible from a solid to a liquid form.

On page 11, please replace the paragraph starting on line 5 with the following:

Figure 1B illustrates the instrument 40, and accompanying components of the assembly in greater detail. Instrument 40 includes an elongated shaft or probe 50 with a proximal end 52 and a distal end 54. Distal end 54 may be sufficiently sharp to penetrate tissue including bone, cartilage, muscle, and fibrous and/or encapsulated tumor masses. In the embodiment shown, distal end 54 is a needle 56 ~~can be a needle~~ that is integral or otherwise coupled to probe 50. Probe 50 may have one or more lumens 58 that may extend over all or a portion of its length. An energy delivery device, generally denoted as 60, is coupled to distal end ~~56~~54. Energy delivery device 60 can be configured to be coupled to an energy or power source 62. The connection is also referred to herein as connecting structure, and may include an fitting, coupling, or fastening suitable for fluid or energy input across or through the structure. A sensor 64 may be coupled to shaft 50 including distal end ~~56~~54 and energy delivery device 60.

On page 11, please replace the paragraph starting on line 17 with the following:

With reference to Figures 1, 2, and 3, introducer 50 can also be coupled at its proximal end 52 to a handle or handpiece 66. All or portions of handpiece ~~68~~66 can be detachable and can include ports 68 and actuators 70. Ports 68 can be coupled to one or more lumens 58 and can include fluid and gas ports/connectors and electrical, optical connectors. At least one of these ports constitutes connecting structure for connecting a suitable liquid reservoir to the distal end tip of the instrument, *e.g.*, a distal-end electrode needle. In various embodiments, ports 68 can be configured for aspiration (including the aspiration of tissue), and the delivery of cooling, conductivity enhancing, electrolytic, irrigation, polymer and other fluids 69 (both liquid and gas) described herein. Ports 68 can include but are not limited to luer fittings, valves (one-way, two-way), toughy-bourst connectors, swage fittings and other adaptors and medical fittings known in the art. Ports 68 can also include lemo-connectors, computer connectors (serial, parallel, DIN, etc) micro connectors and other electrical varieties well known to those skilled in the art. Further, ports 68 can include opto-electronic connections which allow optical and electronic coupling of optical fibers and/or viewing scopes (such as an orthoscope)

to illuminating sources, eye pieces, video monitors and the like. Actuators 70 can include rocker switches, pivot bars, buttons, knobs, ratchets, cams, rack and pinion mechanisms, levers, slides and other mechanical actuators known in the art, all or portion of which can be indexed. These actuators can be configured to be mechanically, electro-mechanically, or optically coupled to pull wires, deflection mechanisms and the like allowing selective control and steering of introducer 50. Hand piece 66 can be coupled to tissue aspiration/collection devices 72, fluid delivery devices 74 (*e.g.* infusion pumps) fluid reservoirs (cooling, electrolytic, irrigation etc) 76 or power source 62 through the use of ports 68. Tissue aspiration/collection devices 72 can include syringes, vacuum sources coupled to a filter or collection chamber/bag. Fluid delivery device 74 can include medical infusion pumps, Harvard pumps, peristaltic pumps, syringes and the like.

On page 12, please replace the paragraph starting on line 13 with the following:

In various embodiments, at least portions of bone treatment instrument 40 including introducer 50 and distal end 54 may be sufficiently radiopaque to be visible under fluoroscopy and the like and/or sufficiently echogenic to be visible using ultrasonography. In specific embodiments, introducer 50 can include radiopaque, magnopaque or echogenic markers 78, at selected locations including along all or portions of introducer 50 including distal end ~~56~~54. Markers 78 can be disposed along introducer 50 to facilitate identification and location of tissue penetrating portion 54 including tissue collection portions, ports, sensors as well as other components and sections of bone treatment apparatus 40 described herein. In an embodiment, markers 78 can be ultrasound emitters known in the art. Also treatment apparatus 40 can include imaging capability including, but not limited to, fiber optics, viewing scopes such as a orthoscope, an expanded eyepiece, video imaging devices, ultrasound imaging devices and the like.

On page 12, please replace the paragraph starting on line 26 with the following:

In various embodiments, instrument 40 can be configured to be percutaneously introduced into the bone through a trocar, bone biopsy device, or orthoscope or other orthopedic access device known in the art. For any of these

devices, apparatus 40 can be introduced with the aid of a guidewire 80 which introducer 50 is configured to track over. Guidewire 80 can be any of a variety of flexible and/or steerable guide wires or hypotubes known in the art. Introducer 50 can have sufficient length to position distal tip 56 in any portion or lobe of the bone 42 using either a percutaneous or a bronchial/transoral approach. The length of introducer 50 can range from 5 to 180 cms with specific embodiments of 20, 40, 80, 100, 120 and 140 cms. The range of an embodiment is from approximately 25 to 60 cms. The length and other dimensional aspects of introducer 50 can also be configured for pediatric applications with a range in these embodiments of 15 to 40 cms. The diameter of introducer 56 can range from 0.020 to 0.5 inches with specific embodiments of 0.05, 0.1 and 0.3 inches as well as 1, 3, 6, 8 and 10 french sizes as is known in the art. Again, the diameter can be configured for pediatric applications with pediatric sizes of 1, 3 and 6 french. In various embodiments, the diameter of distal end 54 can range from 0.010 to 0.1 inches, with specific embodiments of 0.020, .030 and .040 inches. The diameter of distal end ~~56~~54 can be configured to be positioned in individual bronchioles 8' such embodiment includes diameters of 0.40" or smaller.

On page 13, please replace the paragraph starting on line 14 with the following:

In various embodiments, the introducer can be a catheter, multi-lumen catheter, or a wire-reinforced or metal-braided polymer shaft, port device (such as those made by the Heartport® Corp., Redwood City, CA), subcutaneous port or other medical introducing device known to those skilled in the art. In a specific embodiment the introducer is a trocar or a safety trocar and the like. Also as described herein the introducer can be adapted to be coupled to or used in conjunction with various orthopedic devices including but not limited to bone drills, bone chisels, bone dialators, orthoscopes and the like. The introducer can be constructed of a variety of metal grade metals known in the art including stainless steel such as 304 or 304V stainless steel as well shape memory metal such as ~~Nitino~~Nitinol. The introducer can also be constructed from rigid polymers such as polycarbonate or ABS or resilient polymers including Pebax®, polyurethane, silicones HDPE, LDPE, polyesters and combinations thereof.

On page 14, please replace the paragraph starting on line 5 with the following:

Referring to Figures 2 and 3, all or portions of introducer 50 can be configured to be deflectable and/or steerable using deflection mechanisms 82 which can include pull wires, ratchets, latch and lock mechanisms, piezoelectric materials and other deflection means known in the art. Deflection mechanism 82 can be coupled to or integral with a moveable or slidable actuator 84 on handpiece 66. Mechanism 82 and coupled actuator 84 are configured to allow the physician to selectively control the amount of deflection 86 of distal tip ~~56~~54 or other portion of introducer ~~15~~50. Actuator 84 can be configured to both rotate and deflect distal tip 54 by a combination of rotation and longitudinal movement of the actuator. In an embodiment, deflection mechanism 82 comprises a pull wire 80 coupled ~~89~~ to an actuator ~~68~~84 on handpiece 66 described herein.

On page 14, please replace the paragraph starting on line 23 with the following:

Figure 4 is an embodiment of a treatment apparatus having a deflectable portion at the distal end of the introducer. Figure 5 is an embodiment of a bone tumor treatment apparatus 88 having an introducer with a rotatably or hingedly attached deflectable portion. In an embodiment, introducer 90 has a deflectable or articulated section 92 at or near its distal portion 94. Deflectable portion 92 can be formed by use of corrugated or flexible materials (*e.g.* materials having a lower durometer than the adjoining less flexible section of the introducer) crimping, sectioning, molding, or other polymer metal working or catheter processing methods known in the art. Deflectable portion 92 can be deflected using various devices including pull wires, ratchet mechanisms, can mechanisms, and gear mechanisms (including a rack and pinion or worm gear mechanism) coupled to a pull wire or a stiffening mandrel which is advanced and withdrawn through lumen 96. Deflectable portion 92 can also be hingedly or pivotally attached to introducer 90 using a hinge mechanism which comprise one or more hinged sections 98~~h~~ actuated by a pull wire or stiffening mandrel 100. Sections 98 can be mechanically coupled to introducer 90 and each other using one or more hinged or pivot joints known in the art.

On page 16, please replace the paragraph starting on line 20 with the following:

In one preferred embodiment, the energy delivery device 108 is coupled to an RF power supply that provides RF current to one or more RF electrodes 108 . For these and related embodiments, the RF power supply delivers electromagnetic energy in the range from 5 to 200 watts to the electrodes. The electrodes 108 are coupled to the energy source ~~110~~ either directly to each electrode 108, or indirectly using a collet, sleeve, connector, cable and the like which couples one or more electrodes to the energy source ~~110~~. Delivered energies can be in the range of 1 to 100,000 joules, with embodiments having ranges of approximately 100 to 50000 joules, 100 to 5000 joules, and 100 to 1000 joules. Lower amounts of energy can be delivered for the ablation of smaller structures such as nerves and small tumors with higher amounts of energy for larger tumors. Also delivered energies can be modified (by virtue of the signal modulation and frequency) to ablate or coagulate blood vessels vascularizing the tumor. This provides for a higher degree of assurance ablation of the blood supply of the tumor.

On page 17, please replace the paragraph starting on line 3 with the following:

Figures 7A-7~~G~~H show numerous electrode configurations of the treatment device of an embodiment. Figure 8 is an embodiment of a needle electrode configured to penetrate tissue. Figure 9 shows a needle electrode having at least one radii of curvature.

On page 17, please replace the paragraph starting on line 7 with the following:

Figures 7A-7~~G~~H show the distal end region of various instruments, showing the distal end of an introducer 113A-113G and distal-end structure 112A-112~~G~~H associated with the introducer. In Figures 7A-7C, the introducer and electrode are integral with one another, or in the case in Figure 7A, the electrodes are formed as rings on the introducer. In Figures 7D-7H, the electrode is deployable from the distal end of the introducer. Figures 7F and 7H show a needle electrode 112F and 112H, respectively, having injection ports, such as ports 115F, 115~~G~~H, respectively, through which fluid material can be injected. Figures 7G and 7H illustrate an additional feature of a guidewire 117G, 117H, respectively used to

position the introducer and/or electrode. As seen in Fig. 8, the distal end of the electrode 112 can have a cut angle 114 that ranges from approximately 1 to 60 degrees, with embodiments having angles of 25 and 30 degrees, respectively. The surface electrode 112 can be smooth or textured, and concave or convex. A conductive surface area 116 of electrode 112 can range from 0.05 mm^2 to 100 cm^2.

On page 18, please replace the paragraph starting on line 9 with the following:

Electrode 118 can have different lengths ~~124~~ that are advanced from distal end 130 of introducer 132. The lengths can be determined by the actual physical length of electrode(s) 118, the length of an energy delivery surface ~~126~~ of electrode 118 and the length, ~~128~~ of electrode 118 that is covered by an insulator 134. Suitable lengths ~~126~~ include but are not limited to a range from 1-30 cms with specific embodiments of 0.5, 1, 3, 5, 10, 15 and 25.0 cm. The actual lengths of electrode 118 depends on the location of tissue site 122 to be ablated, its distance from the site, its accessibility as well as whether or not the physician chooses a bronchioscopic, percutaneous or other procedure.

On page 18, please replace the paragraph starting on line 18 with the following:

In one general embodiment, the distal-end structure, *e.g.*, one of a ~~plualityplurality~~ of electrodes, is a needle forming a conduit through which liquid can be injected into the tumor, either prior to, during, or following tumor ablation. This embodiment includes additional connecting structure for connecting the needle to a source of liquid under pressure, as will be considered below.

On page 18, please replace the paragraph starting on line 23 with the following:

Figure 10 shows an electrode of a treatment device that includes a lumen and apertures for the delivery of fluid, under an embodiment. Electrode 136 can include one or more lumens 138 (which can be contiguous with or the same as lumen 140) coupled to a plurality of fluid distribution ports 142 (which can be apertures 142) from which a variety of fluids 144 can be introduced, including conductivity enhancing fluids, electrolytic solutions, saline solutions, cooling fluids, cryogenic fluids, gases, chemotherapeutic agents, medicaments, gene therapy

agents, photo-therapeutic agents, contrast agents, infusion media and combinations thereof. This is accomplished by having ports or apertures 142 that are fluidically coupled to one or more lumens 138 coupled to lumens 140 in turn coupled to fluid reservoir 146 and/or a fluid delivery device ~~148~~.

On page 19, please replace the paragraph starting on line 18 with the following:

In an embodiment, a conductivity enhancing solution or other solution ~~158~~156 can be infused into target tissue site 160 including tissue mass 162. The solution can be infused before during or after the delivery of energy to the tissue site by the energy delivery device. The infusion of a conductivity enhancing solution ~~158~~156 into the target tissue 160 creates an infused tissue area ~~164~~ that has an increased electrical conductivity (verses uninfused tissue) so as to act as an enhanced electrode ~~166~~152. During RF energy delivery the current densities in enhanced electrode ~~166~~152 are greatly lowered allowing the delivery of greater amounts of RF power into electrode ~~166~~152 and target tissue 160 without impedance failures.

On page 20, please replace the paragraph starting on line 3 with the following:

An example of a conductivity enhancing solution is a hypertonic saline solution. Other examples include halide salt solutions, and colloidal ferro solutions and colloidal silver solutions. The conductivity of enhanced electrode ~~166~~152 can be increased by control of the rate and amount of infusion and the use of solutions with greater concentrations of electrolytes (*e.g.* saline) and hence greater conductivity. In various embodiments the use of conductivity enhancing solution ~~158~~156 allows the delivery of up to 2000 Watts (W) of power into the tissue site impedance shut down, with specific embodiments of 50, 100, 150, 250, 500, 1000 and 1500 Watts achieved by varying the flow, amount and concentration of infusion solution ~~158~~156. The infusion of solution ~~158~~156 can be continuous, pulsed or combinations thereof and can be controlled by a feedback control system described herein. In a specific embodiment a bolus of infusion solution ~~158~~156 is delivered prior to energy delivery followed by a continuous delivery initiated before or during energy delivery with energy delivery device 152 or other means. For embodiments

of the invention relating to the treatment of bone tumors, infusion solution ~~158~~156 can be delivered through the Haversian Canals as is described herein.

On page 20, please replace the paragraph starting on line 18 with the following:

In various embodiments, the conductivity of the tumor mass 160 can be enhanced. This preferentially increases the rate and total amount of energy delivery to the tumor mass 160 relative to healthy tissue. This is achieved by infusing solution ~~158~~156 directly into the tumor mass 160 through the use of a needle electrode 152 place within the tumor mass only. In related embodiments infusion solution ~~158~~156 can be configured to remain or be preferentially absorbed or otherwise taken up by tumor mass ~~162~~160. This can be achieved by controlling by one or more of the osmolality, viscosity and concentration of solution ~~158~~156.

On page 20, please replace the paragraph starting on line 30 with the following:

The electrode 152 can be made of a variety of conductive materials, both metallic and non-metallic. Suitable materials for the electrode 152 include, steel such as 304 stainless steel of hypodermic quality, platinum, gold, silver and alloys and combinations thereof. Also, electrode 152 can be made of conductive solid or hollow straight wires of various shapes such as round, flat, triangular, rectangular, hexagonal, elliptical and the like. In a specific embodiment all or portions of electrodes 152 and 154 can be made of a shaped memory metal, such as NiTi, commercially available from Raychem Corporation, Menlo Park, California. A radiopaque marker ~~168~~ can be coated on electrodes 152 for visualization purposes.

On page 21, please replace the paragraph starting on line 8 with the following:

Electrode 152 can be coupled to introducer 170 or an advancement member ~~172~~ using soldering, brazing, welding, crimping, adhesive bonding and other joining methods known in the medical device arts. Also, electrode 152 can include one or more coupled sensors 174 to measure temperature and impedance (both of the electrode and surrounding tissue), voltage and current other physical properties of the electrode and adjacent tissue. Sensors 174 can be at exterior surfaces of electrodes 152 at their distal ends or intermediate sections.

On page 21, please replace the paragraph starting on line 15 with the following:

In one general embodiment, the Figure 12A is a treatment device needle having multiple electrodes, under an embodiment. Figure 12B is a treatment device including electrodes coupled to two needles as well as a power supply 177 and ground electrode, under an alternative embodiment. Electrode 176 can comprise two or more electrodes 176 attached to an advancement member ~~200~~ for bipolar electrode configurations and/or an array of electrodes 178 (either bipolar or monopolar). Electrodes 176 and 180 can be coupled to power supply ~~184~~177 and/or ground pad electrode 182 via an insulated wire 188 which can be guidewire 180. The coupling can also be made via a coaxial cable ~~190~~, thereby allowing for coupling of one or both electrodes 176 and 180 to power supply ~~192~~177 as a ground pad electrode 182. Wires ~~194~~188 and ~~190~~180 can also be coupled to a multiplexing device described herein. In use, electrodes 176 and 180 can configured and deployed to seal and/or treat (via ablative hyperthermia and/or ohmic heating) a selectable target tissue volume 196.

On page 22, please replace the paragraph starting on line 11 with the following:

Electrodes 176 can also have sufficient column strength (compressive) and stiffness (flexural) to penetrate harder tissue masses including bone tumor tissue masses or tissue containing bone. The compressive column strength of electrodes 176 can be in the range from 0.1 to 10 lbs with specific embodiments of 0.5, 1, 2.5, 5 and 7.5 lbs. The column strength and stiffness of electrodes 176 can be achieved through the selection of one or more of the following: electrode materials (*e.g.* high strength metals), materials treatments (work hardening, tempering, annealing, etc), thickness and shape (cross sectional profile). In an embodiment, at least a portion of electrodes 176 can be made from a high strength metal such as stainless steal including 304V stainless steal. In a another embodiment electrodes 176 can be fabricated to have an increased stiffness in their distal portions and/or deployed lengths ~~204~~. This can be accomplished through increased electrode thickness, or work hardening the distal electrode sections or a combination of both.

On page 22, please replace the paragraph starting on line 24 with the following:

Electrodes 176 and 180 can be advanced via means of a separate advancement member ~~200~~ positionable in introducer 198 (*e.g.* via lumens ~~206~~) and may be coupled to an actuator ~~208~~ to allow for selectable and controlled advancement of electrode 176 out of introducer 198 and into a selected depth in target tissue site 196. In an embodiment, the advancement member ~~200~~ can be a catheter having one or more lumens ~~210~~ for advancement of wires 186, 188 and 212 and electrodes 176 as well as for the introduction and infusion of fluids ~~214~~ including electrolytic solutions, chemotherapeutic agents, drugs, medicaments, gene therapy agents, contrast agents and the like. In another embodiment, the advancement member ~~200~~ can be a hypotube.

On page 23, please replace the paragraph starting on line 3 with the following:

A deployable member ~~216~~ can be coupled to electrode advancement member ~~200~~. Deployable member ~~216~~ can be configured to provide a variety of different functions including but not limited to the placement of a sensor at a selected tissue site to measure/monitor temperature and/or impedance. Additionally, all or a portion, of deployable member ~~216~~ can be an RF electrode operable in either bi-polar or mono-polar modes. Deployable member ~~216~~ can also be a groundpad electrode. A sensor ~~218~~ can be coupled to deployable member ~~216~~ at a distal end ~~220~~, or at any physical location of deployable member ~~216~~. In this manner, temperature and/or impedance is measured or monitored at a distal portion of tissue site 196 or at any position in or external to tissue site 196.

On page 23, please replace the paragraph starting on line 13 with the following:

Electrodes 176 and 180 can be selectably deployable from introducer 198 or deployable member ~~216~~ with curvature to create any desired geometric area of cell necrosis. The selectable deployment is achieved by having electrodes 176 with, (i) different advancement lengths from introducer 198, (ii) different deployed geometric configurations, (iii) variations in cross-sectional geometries, (iv) selectable insulation provided at each and/or all of the deployed electrodes 176, or (v) the use of adjustable insulation. Deployed electrodes 176 and/or 180 can create a variety of

different geometric cell necrosis zones including but not limited to spherical, semi-spherical, spheroid, triangular, semi-triangular, square, semi-square, rectangular, semi-rectangular, conical, semi-conical, quadrilateral, semi-quadrilateral, rhomboidal, semi-rhomboidal, trapezoidal, semi-trapezoidal, combinations of the preceding, geometries with non-planar sections or sides, free-form and the like.

On page 23, please replace the paragraph starting on line 25 with the following:

Figure 13A is a bone treatment instrument 219 that includes insulation sleeves positioned at exterior surfaces of the electrodes. Figure 13B is a bone treatment apparatus including multiple insulation sleeves that insulate sections of the electrodes, under an alternative embodiment. Figure 13C is a bone treatment device of another alternative embodiment that uses a nonstick coating on the electrodes. Figure 14 is a bone treatment apparatus including insulation that extends along longitudinal sections of electrodes to define adjacent longitudinal energy delivery surfaces, under an embodiment. In these embodiments, one or more electrodes ~~218~~118, as well as deployable member 220, can have an exterior surface that is wholly or partially insulated or coated and provide a non-insulated area which is an energy delivery surface. In the embodiment of Figure 13A, electrodes ~~218~~118 can include insulation 222. In this embodiment insulation 222 is an insulation sleeve 222 that can be fixed or adjustable. The active area of electrodes 118 is non-insulated and provides an energy delivery surface 224. In the embodiment of Figure 13B insulation 222 is formed at the exterior of electrodes 118 in circumferential patterns, leaving a number of energy delivery surfaces 224 which can be ring shaped distributed over the length of electrode 118.

On page 24, please replace the paragraph starting on line 11 with the following:

With reference to Figure 13C, all or a portion of the energy delivery device 118 of an embodiment, including one or more RF electrodes or antennae, can be coated with a nonstick and/or hydrophobic coating 226 configured to eliminate or significantly reduce the adherence of charred or desiccated tissue to the energy delivery device resulting from tissue heating during the ablation process. Coatings 226 can include but are not limited to, ~~polytetraflourethylene~~polytetrafluorethylene,

TEFLON, fluorinated ethylene propylene, perfluoroalkoxy and other ~~flouropolmers~~fluoropolmers, paralene, polydimethysiloxanes (silicones) and polymers and combinations thereof. Such coating can be added via dipping, spraying, co-extrusion, vacuum deposition, vapor deposition; ion beam assisted deposition, diffusion, laser and plasma processes, chemical plating, grafting and other methods known in the art. The coating can be applied as a single coat or in multiple coats using primer coats wherein the coating are configured to have good intercoat adhesion. Further, coatings 226 can be applied evenly over the desire coated length of the energy delivery device 118 or can applied in a graduated fashion with the distal end of the electrode having an increased or decreased thickness with respect to a proximal portion of the electrode.

On page 25, please replace the paragraph starting on line 11 with the following:

With reference to Figure 14, insulation 222 extends along a longitudinal exterior surface of electrodes 118. Insulation 222 can extend along a selected distance along a longitudinal length of electrodes 118 and around a selectable portion of a circumference of electrodes 118. In various embodiments, sections of electrodes 118 can have insulation 222 along selected longitudinal lengths of electrodes 118 as well as completely surround one or more circumferential sections of electrodes 118. Insulation 222 positioned at the exterior of electrodes 118 can be varied to define any desired shape, size and geometric energy delivery surface ~~226~~224.

On page 26, please replace the paragraph starting on line 3 with the following:

Referring to Figure 17, electrode ~~230~~ can be fabricated to assume a helical shape 238. Helical electrode 238 has either a substantially constant radius or varying radius. The longitudinal axis 240 of the helix 238 can be in the same direction as that of the introducer axis 240 or can be perpendicular to this axis. The various embodiments, the angle of the helix 242 can be in the range of 0 to 90° with respect to introducer axis 240 with specific embodiments of 30, 45 and 60°. The angle of the helix can be controlled using a deflection mechanism 252 and/or introducer deflectable portion 244 described herein.

On page 26, please replace the paragraph starting on line 11 with the following:

Referring to Figures 18A and 18B, electrode 230 can be configured to curve in response to a force exerted by the bone-tumor interface 246 to encircle (completely or partially) the perimeter of the tumor 248 one or more times. In various embodiments, this can be achieved through the selection of the material properties of the electrode including but not limited to elastic modulus, percent elongation, yield strength, column strength, diameter, bending modulus, spring constant, degree of tapering and the like. In an embodiment, this is achieved by selection of one or more parameters including bending modulus, wire diameter, and spring constant. A parameter is selected that provides the wire with sufficient flexibility so as to be bent by the bone-tumor interface 246 while providing sufficient spring force and column strength to continue to curve around the perimeter 248 of the tumor ~~250~~234 with continued advancement out of the introducer 236.

On page 29, please replace the paragraph starting on line 20 with the following:

The slidable sheath 268 can be made from a variety of resilient polymers including elastomers, polyesters, polyimides, ~~flouropolymers~~fluoropolymers and the like. Slidable sheath 268 can be configured to be both electrically and thermally insulative or can be electrically and thermally conductive using conductive polymers known in the art. An example of a conductive polymer includes Durethane C manufactured by the Mearthane Products Corporation (Cranston, Rhode Island). Also, all or a portion of the slideable sheath can have radio-opaque, magno-opque, or echogenic markers to facilitate viewing and placement of the sheath using X-ray, CAT scans, NMR ultrasound and the like.

On page 31, please replace the paragraph starting on line 4 with the following:

Other embodiments of the invention can be configured for intraosseous injection of fluids and liquids into the tissue treatment site. Such fluids can include but are not limited to conduction enhancing fluids such as saline solutions, bone cements, carbonated apatite and/or hydroxyapatite, medicaments, ~~chemotherateutic~~ chemotherapeutic agents collagen, biopolymers, osseous tissue, fibroblasts and the like. In an embodiment of the apparatus configured for

intraosseous injection, the introducer 276 includes a shaft with a lumen terminating at a distal end in a frusto-conical connector portion for interconnection with cortical bone tissue and a handle or handpiece associated with the introducer to enable the shaft to be screwed into the cortical bone. The handpiece may extend perpendicularly to the axis of the shaft. The connector may be screw-threaded and may be configured such that when the nozzle of the shaft comes into contact with the cortical bone, a single turn by the user will lock the shaft into the bone into the cortical bore. The proximal end of the shaft can terminate in a hub, this hub defining a recessed portion for the releasable engagement of manipulatable parts.

On page 33, please replace the paragraph starting on line 12 with the following:

Figure 21 shows a bone treatment device 286 in which the introducer is a bone access device, under an embodiment. Figure 22 is a bone treatment apparatus 286 having a threaded bone penetrating introducer, under an alternative embodiment. Figures 23A and 23B show a bone treatment device 286 including an introducer with a bone drill tip, under another alternative embodiment. With reference to these Figures, the introducer, including distal section 288, can be configured for insertion, positioning and anchoring into bone tissue or otherwise provide percutaneous access to a target bone tissue site while still permitting the deployment of electrodes 290. Accordingly portions of introducer 292 can include or otherwise be configured as a bone access or insertion device such as a bone screw, bone drill, bone ~~dialator~~dilator, bone chisel and the like.

On page 33, please replace the paragraph starting on line 23 with the following:

In the embodiment of Figure 21 introducer 292 can be configured as a bone trocar known in the art with a trocar tip 288. Further, introducer 292 has sufficient column strength and distal section 288 including tip 294 has sufficient sharpness and hardness to enable introducer 292 to pushed, rotated or otherwise driven into the bone tissue by the physician. The force can be applied via a proximal fitting or handpiece 296 coupled to the proximal end ~~298~~ of introducer 292. Proximal fitting 296 can be in the shape of a ~~grippable~~gripable handpiece which provides the physician with a leverage point to apply force to introducer 292 including distal

section 288. In an embodiment handpiece 296 can be solid ~~grippable~~gripable cylinder (analogous to that on a wine corkscrew) perpendicular to the longitudinal axis 300 of introducer enabling the physician to simultaneously rotate and apply longitudinal force to the introducer so as to screw the introducer into bone tissue.

On page 34, please replace the paragraph starting on line 13 with the following:

Referring to Figure 22, introducer 292 can include a threaded section 310 having one or more threads with sufficient pitch, strength and profile to allow introducer 292 to be screwed into bone by a physician to reach the desired target tissue site 308. Threaded section 310 may begin at or near distal end 288 and has sufficient to length enable introducer 292 to access a desired bone tissue site from the skin. However, threaded section 310 can be positioned anywhere on introducer 292 and can extend for any length. The length of threaded section 310 can be in the range of 0.1 to 10 cms with specific embodiments of 1, 2.5, 5 and 7.5 cms. The thread design can either be a 'V' profile or a Buttress profile or other profiles known in the art. Also threaded section 310 can be detachably coupled to introducer 292 using snap fit mechanisms, collars, locking tapers, and the like. In another embodiment, threaded section 310 can be crimped onto and around introducer 292 to provide the physician the ability to add and selectively change the length of the threaded section depending on the location and desired point of access of the target bone site 308. Also in various embodiments, all or a portion of threaded section 310 can include apertures 312 to provide for irrigation of the threaded section during the screwing or drilling operations. Apertures 312 can be fluidically coupled to a source of cooling or other fluid ~~314~~ such as an electrolytic fluid or a chemotherapeutic fluid.

On page 35, please replace the paragraph starting on line 13 with the following:

In use, threaded section 310 not only enables introducer 292 to be controllably positioned in a selected bone tissue site 308 but can also be configured to provide tissue samples as well. In specific embodiments bone or tissue cuttings are pushed up the flutes of the threaded sections by bone entering at the cutting point ~~316~~ of the threaded section 310. In this way the physician can ascertain

proper positioning of introducer 292 in the tumor mass 318 by changes in the color or constituency of the tissue shavings existing from the proximal portions of the flutes the threaded sections. Also threaded sections or drill bit 310 can be configured to cauterize the tissue space or track created by the introducer insertion via the generation of frictional heat from the drilling process. This can be achieved via control of one or more of the following parameters: thread shape and pitch, thread/bit diameter, thread/bit materials and drill speed. In a particular embodiment, drill speed can be controlled to be slower during introducer insertion to allow collection of live tissue and the increased upon introducer removal to generate sufficient temperatures (*e.g.* > 50° C) to cauterize or necrose tissue in the drill track. In various embodiment drill speed can range from 1 to 10,000 revolutions per minute (rpm) with specific embodiments of 50, 100, 500, 1000, 2500, 5000 and 7500 rpm.

On page 35, please replace the paragraph starting on line 30 with the following:

Referring to Figures 23A and 23B, the distal end 288 of introducer 292 can be a section 320 configured for use as a bone drill or other bone penetrating device, ~~therby~~thereby enabling introducer 292 to be turned or screwed into bone tissue. In various embodiments tip 320 can have a variety of drill shapes known in the art including but not limited to serrated, star or x-shaped and trocar shaped. The distal end 288 can still have an opening or aperture 232 at its tip 294 or a lateral opening 324 near the tip, one or both configured to allow electrode advancement and deployment into bone tissue site 308 including tumor mass 318. The shape and diameter of opening 322 can be configured to either displace or collect tissue during introduction of the introducer into bone tissue. In a specific embodiment opening 322 along with a lumen 324 are configured to collect a core biopsy sample from bone tissue site 318 during or after positioning of the introducer at the tissue site. In alternative embodiments bit section 320 can in the form of reciprocating bit made of a piezoelectric material that changes its shape when an electric current is applied. This shape change can be configured as an increase in length so as to provide a drill punch affect in a longitudinal direction.

On page 37, please replace the paragraph starting on line 3 with the following:

Figures 25A and 25B are ~~is~~ a bone treatment apparatus having radio frequency (RF) antennas, under an embodiment. Figure 26 is a treatment apparatus having shaped protruding spiral RF antennas, under an alternative embodiment. In various embodiments the distal section 328 of the introducer can include shaped protrusions 330 that act as RF or microwave antennas and the like. Shaped protrusions 330, or antennas, have sufficient surface area and shape to deliver RF energy to a large area of tumor tissue with substantially uniform current density while minimizing charring and tissue desiccation. Each protrusion produces a resulting ablation volume or zone 332 for a given power level and duration of energy delivery. The number and position of protrusions 330 can be configured such that the resulting ablation zones 332 surrounding one protrusion selectively overlaps that of another protrusion. In this way the shape and volume of the resulting ablation zone can be precisely controlled.

On page 38, please replace the paragraph starting on line 11 with the following:

Figure 27 shows the curvilinear/hook-shaped RF antennas of another alternative embodiment. Figure 28 is a treatment apparatus of yet another alternative embodiment that includes a deflection fixture. Figures 29A and 29B show deployment of RF electrodes, under the embodiments of Figures 27 or 28. Introducer 342 includes one or more lateral apertures ~~344~~352 configured to allow the deployment of one or more electrodes. As shown in Figure 27, electrodes 346 can be curvilinear or hooked shaped with the plane of the hook being substantially perpendicular to longitudinal axis 348 or at a selectable angle thereto. Hooked electrodes 350 can have a nondeployed and deployed state. In the non-deployed state hooks are contained within introducer 342. When advanced out of the introducer 342 through side portal 352 and into tissue hook electrodes 350 assume their hooked shape. This can be accomplished by several different embodiments or combinations thereof. In one embodiment hook electrodes 350 are preshaped or given memory (by metallurgical methods described herein) to assume the hook shape once they are released from the interior of introducer 342.

On page 40, please replace the paragraph starting on line 1 with the following:

These two procedures can be performed in succession. First, a specialized, biopsy needle having a removable trocar, or ~~stylett~~stylet, fully inserted into the needle lumen is inserted into and through an appropriate bone structure of the patient, such as the posterior iliac spine (*i.e.* pelvic bone) or sternum, and into the bone marrow cavity. The trocar is removed and an appropriate method for aspirating the desired amount of marrow tissue into the needle lumen is used. Aspiration may be accomplished by rapidly retracting the plunger of an attached syringe thereby creating a upward, suction force, by employing an aspirator bulb, or by another method known in the art.

On page 40, please replace the paragraph starting on line 15 with the following:

Figure 30 shows the use of a core biopsy needle and energy delivery device with the bone treatment device, under an embodiment. The biopsy needle 366 can be used with apparatus 364 either as an integral or separate device. Biopsy needle 366 can includes a handle 368 and an aspirating needle shaft 370. The handle 368 includes a plug receptacle 372, which is associated with the needle shaft 370 by being electrically connected to the proximal end 374 of the needle shaft 370 via a conductor 376 which can be a conductive wire known in the art. An example of a core biopsy needle includes a Jamshidi® needle. In an embodiment energy delivery device 378 can comprise all or a portion of needle shaft 370 or can other be coupled to needle shaft 370. In this and related embodiments, energy delivery device 378 can be an RF electrode or microwave antenna. The use of energy delivery 378 allows the biopsy site 380 and needle tract ~~382~~ to biopsy site to be cauterized and or ablated during or after the biopsy procedure prevent contamination of healthy tissue around the biopsy site.

On page 41, please replace the paragraph starting on line 14 with the following:

Embodiments of bone treatment devices described herein support the measurement and use of different bioanalytes to establish a clinical endpoint for ablative therapies. In an embodiment, carcinoembryonic antigen (CEA) can be used as such an bioanalyte. CEA levels can be measured pre and post therapy,

along with tumor size and ablative margin. Correlations can be established between tumor size reduction (both absolute and %) as well as margin and a database established for individual patients as well a patient population (*e.g.* by tumor type, size etc.). Various curve fitting protocols can be employed to establish such correlations including but no limited to least squares analysis and multivariate analysis. Such a database can be used to establish levels of tumor size reduction and ablative margins for individual patients. Further, in embodiments apparatus 364 can include sensors configured to locally detect levels of CEA in and around the tumor site in order to obtain a more accurate and meaningful measure of CEA levels. Such measurement can be obtained pre, post and inter ablation in order to have immediate, short term and midterm feedback on the ~~effective~~effectiveness of the treatment. Again by taking localized measurements pre and post ablation a more accurate measurement can obtained of CEA levels and thus a more accurate and meaningful clinical endpoint can be established. In embodiments, *in vivo* or *in vitro* sensors to detect CEA can be antibody-based (incorporating a fluorescence or radioactive marker) in order to obtain both a high degree sensitivity and specificity.

On page 42, please replace the paragraph starting on line 12 with the following:

Sensor 386 can be selected to measure temperature, tissue impedance or other tissue property described herein to permit real time monitoring of energy delivery. This reduces damage to healthy tissue surrounding the targeted mass to be ablated. By monitoring the temperature at various points within and outside of the interior of tissue site 394, a determination of the selected tissue mass periphery can be made, as well as a determination of when cell necrosis is complete. If at any time, sensor 386 determines that a desired cell necrosis temperature is exceeded, then an appropriate feedback signal is received at power source ~~396~~397 coupled to energy delivery device 390 which then regulates the amount of electromagnetic energy delivered to electrodes 390.

On page 44, please replace the paragraph starting on line 14 with the following:

Figure 32 shows the use of a bone treatment apparatus of an embodiment to deliver energy and/or fluid through the Haversian canals. Apparatus 400 can be

configured to conduct RF energy or fluids (including conductivity enhancing fluids such as saline) through the Haversian Canals to a target tissue site 402 containing a tumor mass 404. This can accomplished through the use of an energy delivery device 406 comprising one or more long flexible hollow needles which can have a diameter ranging from 0.1 to 1 mm with specific embodiments of 0.2, 0.3, 0.4, 0.5, 0.7, or 0.9 mm. Such needles can have lengths ranging from 0.5 to 20 cms with specific embodiments of 1, 2, 5, 7, 10 and 15 cms. Needles 406 can also include sensors ~~408~~ configured to detect the location of one or more Haversian canals 410. Such sensors can include but are not limited to pressure sensors, ultrasonic sensors (which can both be imaging and velocity sensors via Doppler ultrasound) flow sensors and impedance sensors to detect nerve tissue and nerve pathways within the Haversian Canals.

On page 46, please replace the paragraph starting on line 1 with the following:

Figure 33 is an energy delivery device 418 of an embodiment including a radioactive section. In an embodiment, all or a portion of one or more of the energy delivery devices 420 can include a radioactive portion 422. Radioactive portion 422 is fabricated from a radioactive material having sufficient radioactive strength (*e.g.*, curies) to necrose, ablate, ionize or otherwise kill tumorous tissue 424 at tissue site 426. In related embodiments, a radioactive absorbing sheath 428 can be configured to be slidably positioned over radioactive portion 422 so as to control the exposed length ~~430~~ of radioactive portion 422 and thus the dose of radioactivity delivered to the tumor mass 424.

On page 46, please replace the paragraph starting on line 10 with the following:

The radioactive material in section 422 can include gamma, alpha, or beta emitting materials. Suitable gamma emitters include, but are not limited to. Cobalt-60, Iodine-131, Iodine-123, Indium-111, Gallium-67 and Technetium-99 m. Suitable beta emitting particles include tritium. The amount of radioactive material in portion 422 can be configured to deliver 0.01 to 100 rads of radiation with specific embodiments of 0.1, 0.25, 0.5, 1, 10 and 50 rads. The amount of radiation delivered can measure using a radiation sensor ~~432~~ coupled to energy delivery

device 420 or introducer 434. Radioactive absorbing sheath 428 can include one or more radioactive absorbing materials known in the art which are impregnated or otherwise integral to a flexible metal or polymer layer. Such radioactive absorbing materials include but are not limited to lead, iron or graphite. In an embodiment, the radioactive absorbing material can be fabricated into a braided wire or sheath incorporated into the wall of sheath 428 using catheter production methods known in the art.

On page 50, please replace the paragraph starting on line 15 with the following:

With reference to Figure 34, current delivered through RF electrodes 442 and 444 (also referred to as primary and secondary RF electrodes/antennas) is measured with a current sensor 452. Voltage is measured with a voltage sensor 454. Impedance and power are then calculated using the power and impedance calculation device 456. These values can then be displayed at a user interface and display 458. Signals representative of power and impedance values are received by controller 446 which can be a microprocessor ~~436~~.

On page 53, please replace the paragraph starting on line 20 with the following:

As indicated above, the electrodes, and particularly deployable electrodes, can be shaped so that in the deployed state they form a desired geometric configuration. For example, if the tumor has a significant planar expanse, the electrodes may be shaped to fan out during deployment to form a substantially ~~l~~lanarplanar configuration or array. Likewise, if the tumor mass extends about a portion of the exterior of the cortex of a long bone, the electrodes may fan out during deployment to form a bone-embracing array. This array would define a volume that converges on the distal end of the introducer, i.e., expands on moving away from the distal end. Alternatively, the electrodes might be shaped to curve back in the direction of the distal end of the introducer, that is, define a volume that includes the distal end of the introducer. To this end, the user may preshape or vary the length of one or more of the electrodes, to form an electrode geometry that matches the target region of an individual patient when the electrodes are deployed.